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ABSTRACT

This document contains a developmental curriculum plan for an articulated curriculum in automotive mechanics for Connecticut's Mattatuck Community College and area high schools. The curriculum guide includes a course description, criteria for evaluation, attendance policy, objectives, a curriculum outline, a three-part automotive technician test, and an automotive technician mathematics test. Topics covered in the curriculum are the following: job opportunities; safety; tools and equipment; automobile systems; types of engines; classifying engine types; compression and displacement; manuals; measuring instruments; diagnostic procedures; evaluating a used car; basic engine parts; valve jobs; lubrication system; cooling system; combustion chamber parts; compression and cylinder leakage tests; horsepower and torque; ignition system types and functions; fuel system types; brake system types; automotive electrical systems; and emissions and pollution. (KC)

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A Developmental Curriculum Plan to Achieve a Sequenced Curriculum Between High School Courses in Automotive Mechanics and the Mattatuck Community College Automotive Technician Program.

FINAL REPORT

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PREPARED FOR

CONNECTICUT STATE DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL, TECHNICAL AND ADULT EDUCATION
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MATTATUCK COMMUNITY COLLEGE
ACCESS PROGRAM
AUTOMOTIVE TECHNICIAN

AT 100 INTEGRATED AUTOMOTIVE SYSTEMS (3)

COURSE DESCRIPTION:

Prerequisite: satisfactory academic placement. This is an introductory course for the Automotive Technician providing the theory for a foundation in the field. Emphasis will be on the interrelationship of the various automotive systems. Shop safety, proper care and use of tools are included.

CRITERIA FOR EVALUATION

A. Notebook	10%
1. Organization	
2. Drawing & Diagrams	
B. Independent research paper (Technical) 5-8 pages typed	15%
C. Class participation (attendence requirement)	10%
D. Comprehensive theory examination	50%
E. Auto Shop math examination	15%

ATTENDANCE POLICY

Students are allowed a **maximum** of 10 absences for a one-year course; 5 absences for a 1/2 year course. Excessive absence will result in withdrawl from the ACCESS Program course objectives.

OBJECTIVES

See curriculum outline. Objectives stated at the begining of each section.

CURRICULUM OUTLINE

I. JOB OPPORTUNITIES (WITH AUTO TECH EDUCATION)

Students will be able to:

. list and explain the major career areas in the automotive industry.

A. General Mechanics
B. Auto Electronics
C. Auto Service Writer
D. Auto Service Manager
E. Auto Diagnostician
F. Small Engine Mechanic
G. Motorcycle Mechanic
H. Auto Tools Sales
I. Auto Parts Sales
J. Auto Equipment Sales Representative
K. Auto Radiator Specialist
L. Diesel Mechanic
M. Engine Rebuilder
N. Auto Machinist
O. Auto Front End Mechanic
P. Marine Mechanic
Q. Heavy Duty Equipment Mechanic
R. Auto Body Technician
S. Automotive Engineer
T. High Performance Mechanic
U. Automotvie Instructor (high school or college)
V. Automotive Transmission Technician
W. Other

II. SAFETY ON THE JOB (AUTO TECH)

Students will be able to:

. describe how to dress safely
. identify major causes of accidents
. identify classes of fires and how best to extinguish them
. describe precautions for handling and storing fuels, solvents, refrigerants, and carcinogenic materials.
. list safety precautions in using tools and equipment
. explain why a clean shop is safer than a cluttered one.

A. Attitudes
   1. Pro (A way of thinking)
   2. Con (may hurt himself & others)

B. History of Accidents
   1. Effects on person & family, etc.
   2. How accidents could have been avoided

C. Legislation
   1. "Right to Know" about hazardous material in the work place
   2. Material safety data availabilty

III. USE OF TOOLS AND EQUIPMENT

Students will be able to:

. identify and explain the proper use and operation of

A. Basic hand tools
   1. Ratchet Sets
      a. Drives
         1. (1/4" light duty)
         2. (3/8" standard duty)
         3. (1/2" heavy duty)
         4. (3/4" extra heavy duty)

      b. Accessories
         1. Adaptors (1/4"-3/8", 3/8"-1/4",3/8"-1/2", 1/2"-3/8", 1/2"-3/4", 3/4"-1'2")
         2. Extentions
         3. Breaker Bars
         4. Universal joints
         5. Speeder handle
         6. Allen Wrench Adaptors
         7. Screwdriver Adaptor
         8. Crows Foot Adaptor
         9. Flair Nut Adaptor
         10. Slider Bar

      c. Socket characteristics
         1. Drive (1/4, 3/8, 1/2, 3/4)
         2. Depth (std, deep, extra deep)
         3. # of points (6,12)
         4. Size, (Go over Metric & English std)
         5. Duty (Material of Socket) for impact, etc.

      d. Basic Wrenches
         1. Open End
         2. Box End
         3. Combination

      e. Specialty Wrenches
         1. Torque Wrench
         2. Torx Wrench
         3. Oil Filter
         4. Distributor Wrench
         5. Belt Wrench
         6. Chain Wrench
         7. Flex Head
         8. Tube Wrench
         9. Allen Wrench
         10. Moon Wrench

f. Air Tools
    1. types
    2. uses
    3. precautions

IV. SYSTEMS OF AN AUTOMOBILE

Students will be able to:

. identify the various sytems of the automobile and their functions.

A. Define System

B. Systems of the Engine (only)
    1. Cooling System
    2. Lubrication System
    3. Valve Train System
    4. Fuel System
    5. Ignition System
    6. Exhaust System
    7. Computer Control System
    8. Starting (Cranking System)

C. Systems of an Automobile (other than engine)
    1. Air Conditioning
    2. Suspension System
    3. Heating System
    4. Electrical System
    5. Charging System
    6. Steering System
    7. Audio System
    8. Brake System
    9. Gauges & Engine Monotoring
    10. Emission Control System

V. TYPES OF ENGINES STUDENTS MUST UNDERSTAND

Students will be able to:

. explain theory and principals of operation of each engine type.

A. Theory & Principal of Operations
    1. 4 cycle (gas)
    2. 2 cycle (gas)
    3. 4 cycle (diesel)
    4. 2 cycle (diesel)
    5. Wankel (Rotary Piston Engine)
    6. Gas Turbine Engine
    7. Optional Engines
        a. Rocket Engine
        b. Jet Engine
        c. Steam Engine Turbine & Piston
        d. Electric Motor

VI. CLASSIFYING ENGINE TYPES

Students will be able to:

. classify engines according to each of the following categories

A. # of cylinders
B. Compression Ratio
C. Fuel Type
D. Type of Fuel System
E. Ignition System
F. # of Strokes
G. Cooling System
H. Horsepower
I. Size or Displacement
J. Valve Train Type
K. Block design (cylinder configuration)

VII. COMPRESSION & DISPLACEMENT

Students will be able to:

A. Compute Compression Ratios
B. Compute Displacement of Engines
C. Convert Metric to English
D. Convert English to Metric

VIII. MANUALS

Students will be able to:

. identify the type, use, and importance of manuals

A. Type (Factory, General, Chiltons, Motors, specialty (Transmission)
B. Use (Important tool for all technicians)
C. Computers (store & use of material)

IX. MEASURING INSTRUMENTS

Students will be able to:

. identify and explain the proper use of

A. Measuring instruments
    1. Micrometers
    2. Dial caliper
    3. Digital caliper
    4. Dial Indicator
    5. Feeler Gauge

B. Uses & How to Use

X. ENGINE R & R PROCEDURES

Students will be able to:

. list and explain proper R & R Procedures

XI. HOW TO EVALUATE A USED CAR

Students will be able to:

. list and explain evaluation procedures

XII. ENGINE: BASIC COMPONENT PARTS

Students will be able to:

. identify and describe the function of each part.

A. Piston Types
1. Dome
2. Flat
3. Knotched
4. Irregular
5. Concave (Dish)
6. Wedge

B. Piston Parts
1. Head
2. Ring Groove
3. Land
4. Pin Boss
6. Expansion slot
7. Heat Dam
8. T slot
8. Skirt

C. Valve Train Types
1. I Head
2. L Head
3. F Head
4. T Head
5. H (Hemi) Head
6. DOHC
7. SOHC
8. OHV
9. OHC

D. Parts of a Valve
1. Head
2. Face
3. Neck
4. Stem
5. Tip
6. Keeper Groove
7. Seat

XIII. DOING A VALVE JOB

Students will be able to:

. reface valves using

A. Base Angles
B. Interference Angles
C. Competition 3 Angles Valve

Students will be able to:

. list advantages of interference angle

XIV. LUBRICATION SYSTEM

Students will be able to:

. identify

A. Types of Systems

B. Types of Filtering System

C. Oil (Lubricants) Properties
1. Viscosity
2. Detergents
3. Film strength
4. Anti Oxidizing Agents
5. Rust Inhibitors
6. Pour Point Depressent

D. The Job Of Lubricant
1. Cools
2. Cleans
3. Prevents Oxidation
4. Reduces Friction
5. Seals
6. Absorbs Shock

XV. THE COOLING SYSTEM

Students will be able to:

. identify components and functions

A. Function-to keep engine at operating temperature
1. Coolant
2. Radiator
3. Radiator Cap
4. Radiator Hoses
5. Fan
6. Drive Belts
7. Fan Clutch
8. Fan Shroud
9. Thermostat
10. Recovery Tank
11. H2O Jackets
12. Heater Core
13. Temperature sender & Gauge

XVIII. FIGURING OUT H.P. & TORQUE

Students will be able to:

. explain and calculate

A. Types of Horsepower
   Example 1. Din HP
   2. Brake HP

B. Torque (twisting power)
   Units 1. Newton-Meters (Metric)
   2. Foot-Pounds (English)

XIX. IGNITION SYSTEM (TYPES) AND FUNCTIONS

Students will be able to:

. identify types, components, and functions

A. Old (point typed)
B. Transistorized ignition
C. C.D. (Capacitor Discharge)
D. Magnetic Impulse
E. Photo Electric
F. Magneto
G. Distributorless
H. Hall Effect
I. Primary Ignition Circuit
   1. Battery
   2. Wires & Connections
   3. Transistor or Points (module)
   4. Photo or Magnetic or Hall Pickup
   5. Coil Primary Windings
J. Secondary Ignition Circuit
   1. Coil secondary winding
   2. Coil secondary wire
   3. Distributor Cap
   4. Rotor
   5. Spark plug wire
   6. Spark Plug

XX. FUEL SYSTEM TYPES

Students will be able to:

. identify types, components, and functions

A. Carburator
   1. Multiple Carburators or Barrels
      1. 1, 2, 4 Barrel carburators
      2. 1, 2, 3 or more carburators

Optional
1. Electric Fan Motor
2. Electrice Fan Switch
3. Oil Cooler (Engine)
4. Oil Cooler (Transmission)

XVI. COMBUSTION CHAMBER PARTS

Students will be able to:

. identify components and functions

A. Head
B. Intake Valve
C. Exhaust Valve
D. Head Gasket
E. Piston
F. Piston Rings
G. Cylinder
H. Spark Plug

XVII. COMPRESSION & CYLINDER LEAKAGE TEST

Students will be able to:

. perform and interpret compression test and explain cylinder leakage test

A. Compression test prerequisites
   1. Get Engine to Operating Temperature
      a. Clearances
      b. Oil Viscosity
   2. Engine (Cranking) starting system (must be in working order (100 RPM MIN)

B. Dry test (results)

C. Wet test (results)
   1. WHY

D. Cylinder leakage test (100 psi. Min.)
   1. Bad intake valve (Noise out of Carb. or FL. itself)
   2. Bad Exhaust valve (Noise out of Exhaust Pipe)
   3. Bad Head Gasket or Crack in Head (Block) Bubbles in Coolant)
   4. Bad Rings, Piston, or Cylinder (Noise out of Oil filter) (Breather)

B. Fuel injection systems
    1. Types
        a. Throttle Body
        b. Ported
        c. C.I.S. (Constant Fuel Injection System)
        d. Electronic Fuel injection system (E.F.I.)
        e. Mechanical Fuel injection (Some Gas Engine)
           all * Diesel Engines

C. Parts of a Fuel system (in general)
    1. Gas tank
    2. Gas cap (vented/nonvented)
    3. Gas lines (type)
    4. Gas Filter (location & testing)
    5. Fuel pumps (types) Mechanical & Electric
    6. Intake Manifold
    7. Air intake & cleaners (functions & importance)
    8. Fuel injection system of Carburators

D. Advantage of Fuel injection over Carburators
    1. *Lower Emmissions (less pollution)
    2. *Better Fuel Mileage
    3. *More Power
    4. *Easier Starting

*Explain why

XXI. <u>BRAKE SYSTEM TYPES</u>

Students will be able to:

. identify types, components, and functions:

A. Mechanical
    1. Disc-caliper
    2. Drum type

B. Hydraulic System
    1. Master Cylinder
    2. Wheel Cylinder
    3. Calipers
        a. types
    4. Proportioning Valve
    5. Pressure Differential Valve
    6. Combination Valve

C. Power Brake System
    1. Vacum Power Booster
    2. Air Brakes
    3. Power Hydraulic System

D. A B S (Brake Systems) Introduction

E. Basic trouble shooting & testing

XXII. AUTOMOTIVE ELECTRICAL SYSTEMS

Students will be able to:

. explain the basic theories and principles of electricity

. identify components, their functions, and testing

A. Battery Testing

B. Charging system
   1. types
   2. testing

C. Starting System
   1. Parts
      a. starter
      b. solenoid
      c. starter relay
      d. ignition switch
      e. wires & connection
      f. battery

D. Electricity
   1. What it is
   2. How it works
   3. Units of measurements
      a. Volts c. Ohms
      b. Amps d. Watts
   4. Ohms Law (Unit Relationship)
   5. Types of basic electrical circuits
      a. series
      b. parallel
      c. series-parallel
   6. Basic Electrical Problems
      a. short
      b. open
      c. ground circuit
      d. bad ground circuit
   7. Electrical trouble-shooting equipment
      a. jumper wire
      b. volt meter
      c. Amp meter
      d. Ohms meter
      e. test light

XXIII. EMISSIONS & POLLUTION

Students will be able to:

. explain automotive emissions, its causes, and how they can be controlled.

1. Emissions
   - A. Combustion
     (Air) [N2+O2+CO2] + [HC] (Gas) = NOx+C+CO+H2O+O2+CO2
   - B. Ideal Combustion
     N2+O2+CO2+HC = H2O+CO2+N2
   - C. Polluted Combustion
     N2+O2+CO2+HC = NOx+C+CO+H2O+CO2
   - D. How Automotive Equipment Combats Emmisions
     1. Precombustion
        a. Vapor Recovery (Gas Tank)
        b. PCV (Positive Crankcase Ventilation)
        c. fuel injection
        d. temp controlled intake (Thermac Air Cleaner)
        e. High temp cooling system
     2. Combustion
        a. Combustion Chamber (shape)
        b. spark advance & timing
        c. spark plug gap & ignition output
        d. camshaft
        e. compression ratio
        f. fuel (unleaded)
        g. EGR (Exhaust Gas Recirculation)
     3. Post Combustion
        a. AIR (Air Injection Reactor)
        b. catalytic convertor
           1. Oxidizing
           2. Reducing
        c. O2 sensor
           1. Feedback to the computer

MATTATUCK COMMUNITY COLLEGE
ACCESS PROGRAM
AUTOMOTIVE TECHNICIAN TEST

The instructor is required to have covered shop safety, proper use of tools, and shop practices and procedures. If the high school instructor feels the student has not mastered safety, tools, shop practices, and procedures the student will not be given credit.

1. The shape(s) of a piston head is/are _____.

a. flat
b. doomed
c. irregular
d. all of the above

2. The thick area of the piston which supports the piston pin is called the piston _____.

a. boss
b. sidewall
c. crown
d. support

3. The part of a piston which expands the most is called the _____.

a. boss
b. skirt
c. crown
d. none of the above

4. The job of the mainbearings is to _____.

a. support the camshaft in the engine
b. support the auxiliaryshaft
c. connect the piston to the camshaft
d. none of the above

5. The job of the valve spring is to _____.

a. close the valves as the camshaft rotates
b. open the valves as the camshaft rotates
c. close the valves as the crankshaft rotates
d. open the valve as the crankshaft rotates

6. The motion of the piston in the cylinder is best described as _____.

a. reciprocating
b. rotary
c. vacillating
d. none of the above

7. Throws, journals and counter weights are all parts of the _____.

a. camshaft
b. connecting rod
c. engine block
d. crank shaft

8. To reduce crankshaft "twisting" during power strokes some engines have _____.

a. counter weights
b. vibration dampers
c. connecting rods
d. both a & b

9. Connecting rods and main bearings are classified as _____.

a. sleeve bearings
b. roller bearing
c. needle bearing
d. ball bearing

10. The part of the engine which is steel blocked with layers of copper, lead, and tin is a _____.

a. piston
b. connecting rod
c. precision insert bearing
d. push rod

11. _____ are used to seal the piston in the cylinder.

a. bolts
b. rings
c. bearing
d. heat domes

12. A piston has _____ thrust surface.

a. 2
b. 4
c. 6
d. 8

13. Which is the best defintion of an engine?

a. a device used to propel a car
b. a group of parts made of metal
c. a group of related parts in specific order designed to convert heat energy to mechanical energy
d. a group of related parts which are put together to convert rotary motion to reciprocal motion.

14. The two types of lifters commonly found in engines are the _____ and _____ type.

a. hydraulic and oil operated
b. mechanical and solid
c. solid and metallic
d. hydraulic and mechanical

15. Rotators are used on valves to _____.

a. prevent carbon buildup
b. prevent localized heat
c. both a and b
d. none of the above

16. Storage batteries contain a liquid called _____.

a. sulphuric acid
b. water
c. electrolyte
d. hydrometer

17. The effects of battery acid on other objects can be neutralized with _____.

a. sulphuric acid
b. hydrometer
c. pie crust
d. baking soda and water

18. Storage batteries produce _____ gas.

a. hydrogen
b. nitrogen
c. lithium
d. phosphorus

19. _____ water should be used to fill a storage battery.

a. tap
b. chlorinated
c. fluoridated
d. distilled

20. Specific gravity of battery electrolyte is tested with a _____.

a. battery tester
b. hydrometer
c. voltmeter
d. capacity tester

21. Each cell in a 12 volt battery produces approximately _____ volts.

a. 1.6
b. 2.1
c. 3.4
d. 12.6

22. We can check ignition timing with a _____.

a. compression test
b. tach and dwell meter
c. timing light
d. none of the above

23. What should be checked on new spark plugs? _____

a. electrodes
b. gap
c. threads
d. all of the above

24. Permanent anti-freeze should be changed every _____ months.

a. 6
b. 12
c. 24
d. 48

25. Radiators are pressurized to _____.

a. raise the boiling point of the coolant
b. lower the boiling point of the coolant
c. speed the flow of coolant through the engine
d. operate the water pump

26. A thermostat installed upside down will cause an engine to _____.

a. run cold
b. not stop
c. not start
d. run hot

27. Supplying the engine with a combustible mixture of air and fuel and changing the proportions under differing conditions best describes the automobiles _____.

a. intake manifold
b. fuel system
c. lubrication system
d. fuel pump

28. Providing a high voltage surge, 30,000 volts or more to the spark plugs best describes the purpose of the _____.

a. storage battery
b. alternator
c. electrical system
d. ignition system

29. Which part/parts belong to the engine lubrication system?

a. pick-up screen
b. pressure relief valve
c. filter
d. all of the above

30. P.C.V. stands for _____.

a. pollution control valve
b. positive crankcase ventilation
c. positive crankshaft velocity
d. pollution control ventilation

31. Since cars run on DC voltage and alternators produced AC current, this AC current must be _____.

a. reversed
b. rectified
c. revolted
d. amplified

32. Oil is used in engines as _____.

a. a cleaning agent
b. a cooling agent
c. a seal between rings and cylinder walls
d. all of the above

33. How easily an oil flows or spreads as referred to as _____.

a. viscosity
b. body
c. fluidity
d. none of these

34. SAE is an abbreviation for _____.

a. stationary automobile engines
b. society of automobile engineers
c. static automotive energy
d. none of these

35. Since oil pumps can produce more pressure than is required for the engine a _____ is incorporated in the system.

a. by-pass valve
b. pcv valve
c. shunt valve
d. relief valve

36. The ease at which gasoline vaporizes is referred to as _____.

a. octane
b. volatility
c. heptane
d. cetane

37. A secondary explosion in the combustion chamber after the spark plug has fired is called _____.

a. detonation
b. pre-ignition
c. dieseling
d. spontaneous combustion

38. Ignition of the fuel charge before the sparkplug fires is called _____.

a. detonation
b. pre-ignition
c. knocking
d. spontaneous combustion

39. The four-stroke cycle operates in which order _____.

a. intake, exhaust, ignition, compression
b. ignition, power, exhaust, compression
c. compression, power, intake, exhaust
d. intake, compression, power, exhaust

40. Valves are opened by _____.

a. camshaft lobes
b. connecting rods
c. the crankshaft
d. valve springs

41. Which of the following is not used in calculating engine displacement.

a. stroke
b. bore
c. number of cylinders
d. valve arrangement

42. Piston rings _____.

a. are metal rings that fit into grooves in the piston
b. form a tight seal between the piston and the cylinder wall
c. both a and b
d. neither a nor b

43. The reciprocating motion of the piston is changed to rotary motion by _____.

a. a crankshaft and crankpin
b. a piston and piston pin
c. a piston ring and piston pin
d. a connecting rod and crankshaft

44. The letters TDC stand for _____.

a. top dead center
b. turning direction clockwise
c. transposed direct current
d. none of the above

45. In a four-cycle engine, a power stroke occurs every _____.

a. crankshaft revolution
b. other crankshaft revolution
c. fourth crankshaft revolution
d. half-revolution of the crankshaft

46. The compression ratio in a diesel engine is _____.

a. lower than in a spark-ignition engine
b. higher than in a spark-ignition engine
c. the same as in a spark-ignition engine
d. none of the above

47. All diesel engine use _____.

a. fuel injection
b. the two stroke cycle
c. a blower
d. multiple carburetors

48. Firing order is _____.

a. the order in which the cylinders deliver their power strokes
b. the number assigned to each cylinder by the engine manufacturer
c. the same as cylinder numbering
d. none of the above

49. Engines with the same arrangements of cylinders _____.

a. always have the same firing order
b. may have different firing orders
c. use the same intake manifold
d. are always carburetor

50. An engine that can selectively cut out two or four cylinders is a _____.

a. multiple-displacement engine
b. diesel engine
c. five-cylinder engine
d. rotary engine

51. In a diesel engine, ignition is provided by _____.

a. a spark plug
b. heat of compression
c. a battery
d. exploding gasoline

52. The assembly of tubes through which the air fuel mixture flows from the carburetor to the intake ports is the _____.

a. cylinder head
b. intake manifold
c. valve ports
d. exhaust manifold

53. The assembly of tubes through which the burned gases flow from the exhaust ports to the exhaust pipe is the _____.

a. intake manifold
b. muffler
c. exhaust manifold
d. catalytic converter

54. The bearing that supports the crankshaft is called _____.

a. connect-rod bearing
b. main bearing
c. camshaft bearing
d. bushing

55. The device mounted on the front end of the crankshaft to reduce torsional twist _____.

a. flywheel
b. thrust bearing
c. vibration damper
d. pulley

56. The space between the piston and the cylinder wall is called the _____.

a. piston dome
b. piston clearance
c. piston grooves
d. piston rings

57. Compression rings seal in the compression pressure and _____.

a. prevent blow by
b. contorl oil consumption
c. reduce valve temperature
d. a & b

58. The camshaft rotates at _____.

a. one-half crankshaft speed
b. crankshaft speed
c. twice crankshaft speed
d. none of the above

59. The time that both valves are open together is called _____.

a. valve overlap
b. valve clearance
c. valve lash
d. valve rotation

60. The purpose of the screw and locknut in some rocker arms is to _____.

a. eliminate tappet noises
b. hold the rocketarm in position
c. allow for valve-clearance adjustments
d. all of the above

61. Devices that turn the valves slightly each time they open _____.

a. valve retainer
b. valve rotators
c. valve retractors
d. none of the above

62. The oil-filled device used in valve trains to eliminate adjustments and to reduce the noise are _____.

a. hydraulic valve lifters
b. mechanical valve lifters
c. both a and b
d. neither a nor b

63. The purpose of the belt tensioner used with a belt driven overhead camshaft is to _____.

a. eliminate noise
b. preload the camshaft bearing
c. prevent the camshaft from jumping time
d. all of the above

64. Engine torque is _____.

a. the twisting force the engine delivers at the crankshaft to the crankshaft
b. the rate at which the engine is working
c. both a and b
d. neither a nor b

65. A spark-ignition engine with throttle open develops more torque at _____.

a. low speed
b. intermediate speed
c. high speed
d. very high speed

66. On an outside micrometer, the part that turns to indicate the reading is the _____.

a. barrel
b. anvil
c. racket screw
d. thimble

67. When the piston moves from the top of the cylinder to the bottom of the cylinder which of the following has occured? _____.

a. a cycle
b. a stroke
c. both a and b
d. neither a nor b

68. A mixture of air and fuel enters the cylinder on the _____.

a. intake stroke
b. compression stroke
c. power stroke
d. exhaust stroke

69. The burned gases leave the cylinder on the _____.

a. intake stroke
b. compression stroke
c. power stroke
d. exhaust stroke

70. Crankshafts are made by _____.

a. forging
b. casting
c. machining
d. all of the above

71. Which of the following is/are a bearing requirements _____.

a. embedability
b. conformability
c. heat transfer
d. all of the above

72. The characteristic of a bearing that allows dirt to stick in it is called _____.

a. embedability
b. conformability
c. heat transfer
d. all of the above

73. Which of the following are parts of the valve train _____.

a. camshaft
b. lifter
c. valve
d. all of the above

74. The amount of time the valve is opened is called _____.

a. lift
b. duration
c. overlap
d. ratio

75. The distance the valve is opened is called _____.

a. lift
b. duration
c. overlap
d. lash

76. The space in the valve train for heat expansion is called _____.

a. lash
b. clearance
c. both a and b
d. neither a nor b

77. The valve seat is part of the _____.

a. valve
b. cylinder
c. runner
d. none of the above

78. The lowest category of service rating of engine oil is _____.

a. SA
b. SB
c. SD
d. SE

79. Oil viscosity rating are set up by _____.

a. API
b. SAE
c. DIN
d. both a and b

80. Oil service rating are set up by _____.

a. API
b. SAE
c. DIN
d. both a and b

81. Which of the following types of cooling system are used today _____.

a. liquid
b. air
c. both a and b
d. neither a nor b

82. Which of the following are caused by overcooling _____.

a. poor mileage
b. high emissions
c. oil dilution
d. all of the above

83. When the engine is cold, coolant flows _____.

a. into the bottom radiator tank
b. only through the block
c. only through the heat exchange
d. none of the above

84. A vacuum is prevented in the radiator by the _____.

a. pressure cap
b. coolant recovery system
c. both a and b
d. none of the above

85. Which of the following is a type of fan _____.

a. flex
b. fixed blade
c. clutch
d. all of the above

86. Displacement is measured in _____.

a. cubic inches
b. cubic centimeters
c. both a and b
d. neither a nor b

87. An engine size is specified by _____.

a. bore
b. stroke
c. displacement
d. all of the above

88. Horsepower measured at the flywheel is _____.

a. 1 HP
b. BHP
c. plank
d. taxable

89. An engine with the cylinders placed in a straight line is which of the following arrangement _____.

a. V-Type
b. in-line
c. opposed
d. transverse

90. An engine with the valves located in the cylinders head is which of the following types _____.

a. V-Type
b. overhead
c. flathead
d. opposed

91. An engine that uses high compression for ignition is which of the following types _____?

a. diesel
b. opposed
c. flathead
d. overhead

92. Most chainsaw engines are which of the following types _____?

a. flathead
b. four stroke
c. two stroke
d. overhead

93. The part of the piston that contacts the cylinders walls is the _____:

a. head
b. skirt
c. boss
d. land

94. Which of the following parts connects the piston to the connecting rod _____?

a. rings
b. bearing
c. piston pin
d. skirt

95. Piston expansion is controlled by _____:

a. strut
b. dam
c. slot
d. all of the above

96. Compression pressures are controlled by _____:

a. compression rings
b. oil control rings
c. both a and b
d. neither a nor b

97. Oil is prevented from entering the combustion chamber by _____.

a. compression rings
b. oil control rings
c. both a and b
d. neither a nor b

98. Engine condition may be determined with a(n) _____.

a. oil pressure gauge
b. compression gauge
c. cylinder leakage tester
d. all of the above

99. Which of the following is a type of cylinder wear _____?

a. taper
b. out-of-round
c. both a and b
d. neither a nor b

100. Cylinders may be serviced by _____.

a. glaze breaking
b. honing
c. boring
d. all of the above

101. New pistons are required after _____.

a. glaze breaking
b. honing
c. boring
d. all of the above

102. Valve guides may be serviced by _____.

a. replacement
b. knurling
c. sleeving
d. all of the above

103. The engine oil level is checked with _____.

a. warning light
b. pressure gauge
c. dip stick
d. none of the above

104. The oil pressure is checked with _____.

a. warning light
b. pressure gauge
c. dip stick
d. none of the above

105. Oils should be changed more for _____.

a. a short trip driving
b. highway driving
c. warm weather driving
d. none of the above

106. Oil should be changed _____.

a. while the oil is hot
b. while oil is cold
c. either a or b
d. none of the above

107. It is best to change the oil filter _____.

a. every oil change
b. every other oil change
c. every third oil change
d. none of the above

108. Coolant may be lost _____.

a. inside the engine
b. outside the engine
c. both a and b
d. neither a nor b

109. Overheating may be caused _____.

a. poor heat flow
b. poor coolant flow
c. poor air flow
d. all of the above

110. Poor air flow may be caused by _____.

a. clogged radiator finns
b. a slipping fan belt
c. a defective fan clutch
d. all of the above

111. The coolant strength may be determined with a _____.

a. pump
b. hydrometer
c. pressure tester
d. all of the above

112. During the power stroke, the intake and exhaust valves are _____.

a. closed and opened
b. opened and closed
c. both closed
d. both opened

113. When gasoline is burned in the engine, the pollutants that come from the tail pipe are _____.

a. HC, CO, and NOx
b. H2O, Co2,and O
c. O, C, H, and N
d. none of the above

114. Ringing is the characteristic sound of _____.

a. normal combustion
b. pre-ignition
c. lead fuel
d. all of the above

115. Which of the following statements is/are true _____?

I. Carbon deposits in the combustion chamber raise the compression ratio.
II. Carbon deposits in the combustion chamber increase the tendency detonation to occur in an engine.

a. I only
b. II only
c. both I and II
d. neither I nor II

116. The purpose of the EGR system is to _____.

a. push more air-fuel mixture into the engine
b. keep the battery changed
c. increase the compression ratio
d. none of the above

117. The reason that a richer mixture must be delivered when a cold engine is first started is that _____.

a. this allows a higher cranking speed
b. only part of the gasoline will vaporize when cold
c. the thick engine oil must be thinned out
d. none of the above

118. An air fuel ratio of 12-1 means that the mixture has _____.

a. 12pds of gasoline to 1 pd of air
b. 12pds of air to 1 pd of gasoline by weight
c. 1 gallon of gas to 12 gallons of air
d. 12 gallons of air to 1 gallon of gas

119. The 3 major pollutants in automobile exhaust are _____.

a. sulfates, particulates, carbon dioxide
b. sulfates, carbon monoxide, nitrous oxide
c. carbon monoxide, oxides of nitrogen, hydrocarbons
d. hydrocarbons, carbon dioxide, nitrous oxide

120. Carbon monoxide is a result of _____.

a. incomplete combustion
b. a lean mixture
c. excess oxygen
d. impurities in the fuel

121. The combustion chamber is usually contained in the _____.

a. engine block
b. piston
c. cylinder head
d. water jacket

122. When turning a scored brake drum, the maximum oversize limit for most cars would be _____.

a. 0.060"
b. 0.030"
c. 0.090"
d. 0.110"

123. The most common type of disc brake caliper found on American cars is the _____.

a. Single piston sliding
b. Two piston fixed
c. Two piston sliding
d. Four piston fixed

124. To check rotor parallelism you use a _____.

a. Straight-edge
b. Micrometer
c. Dial indicator
d. Special service tool

125. A vehicle is equipped with power disc brakes. The owner says that in order to stop the car excessive pedal effort is required.

Mechanic A says that a faulty power booster is probably the cause.
Mechanic B says that air in the hydraulic system is probably the cause.

Who is right?
a. Mechanic A
b. Mechanic B
c. both A and B
d. neither A nor B

126. The figure 0.0005" is the dimension commonly used for maximum _____.

a. Rotor laternal run-out
b. Rotor parallelism
c. Rotor radial run-out
d. Caliper bore wear

127. In an engine with an overhead camshaft the valves are located in _____.

a. the engine block
b. the crankshaft
c. the cylinder head
d. none of the above

128. Modern day engines have pistons made of _____.

a. tungsten
b. bronze
c. steel
d. aluminum

PART TWO

129. Explain Detonation

130. Explain Pre-Ignition

131. Why are pistons cam ground?

132. Explain the stratified charge combustion chamber and why it is used.

133. Describe valve overlap and why it is used.

134. Why is it necessary for valves to be adjusted and what would happen if they were not adjusted?

135. Why are catalytic converters used and briefly explain what they do.

136. What is the purpose of sodium filled valves and how do they work?

137. Why are three or more valve seats angles used when grinding a seat?

138. Why are Turbochargers more widely used today than in the past and why.

139. List four engine types.

140. Explain what is meant by the terms 10:1 compression ratio.

PART III.

141. Explain five types of processes we can do with Ox-Acyt torch and draw the three basic types of flames and label.

142. List three units of displacement.

143. Draw and label 6 types of Piston Head shapes.

144. List six functions (jobs) the lubrication system does.

145. Draw and label a Lubrication System.

146. List eleven parts of Cooling System.

147. Name all parts of a Piston.

148. Name four advantages of Fuel Injection over Carburation.

149. Draw a water parallel picture to Electricity and explain in detail each unit of electricity.

150. List seven system incorporated in an automobile engine. (in order for it to function)

151. List ten parts of the OHV valve train.

152. Name five materials gaskets can be made of.

153. Explain in detail how a 2 cycle Diesel works (diagrams of strokes needed).

154. Explain how to do wet and dry compression test (give some probable results).

155. Draw a 30 degree base angle and 45 degree angle competition valve job.

156. Name 10 systems incorporated in automobile other than the engine.

157. Name 5 differences of a diesel engine compared to a gas engine.

158. Name 8 parts of a combustion chamber.

159. Define combustion.

160. Define R.P.M.

161. Define T.D.C.

162. Define system.

163. Name 15 job opportunities in the Automotive Field.

164. Explain in detail with diagrams the four stroke of the internal combustion engine.

165. How would you properly maintain your cooling system and give reasons why?

166. Explain why a choke system is necessary on carburetors.

167. Explain the Venturi Effect and how it is put to use in the fuel system.

168. Explain in detail how the automotive alternator works. (including rectification, voltage, regulator operation)

169. Draw a basic starting system.

170. Explain in detail how a starter system works. (including starter drives and solenoids)

171. Why do some diesel engines use glow plugs and explain what they are?

172. Explain why most automobile manufacturers are changing from carburetors to fuel injection systems.

173. List the components necessary for a basic fuel injection system.

174. Explain in detail the types, uses, and importance of shop manuals.

MATTATUCK COMMUNITY COLLEGE
AUTOMOTIVE TECHNICIAN
MATH TEST

PLEASE SHOW ALL CALCULATIONS

1. What is the displacement of an eight-cylinder engine that has a 3.5 inch bore and a 3.75 inch stroke?

2. Convert the answer obtained in question 1 into cubic centimeters.

3. What is the displacement of a four-cylinder engine in which bore and stroke are both 3.1 inches?

4. Convert the answer obtained in question 3 into liters.

5. What is the displacement of a four-cylinder engine that has an 8 cm bore and a 10 cm stroke? Give your answer in two commonly used metric units.

6. Convert the answer obtained in question 5 into cubic inches.

7. Coolant temperature of an engine is 80 degrees centigrade. Convert this reading to the Fahrenheit scale.

8. What is the compression ratio of an engine with a 50.3 cu. in. displacement per cylinder, with a combustion chamber cavity of 6.7 cu. in. ?

9. What is the compression ratio of an engine with a 322.5 cm3 displacement per cylinder, with a combustion chamber cavity of 43 cm3?

10. If an eight-cylinder engine with a 3.5 inch bore and a 3.75 inch stroke produces its maximum horsepower at 4400 rpm, what is its indicated horsepower when the average indicated pressure is 131 lb/in2?

11. The engine specified in question 10 produces 221 ft-lb of torque at 4400 rpm. What is the brake horsepower?

12. What is the mechanical efficiency of the engine specified in questions 10 and 11?